What is claimed is:

1. A heat exchanger for extracting heat from a microprocessor whose die has an exposed non-active surface extending above and parallel to a generally planar surface of said microprocessor, comprising:

a body through which a fluid may be circulated;

a protrusion extending from said body, said protrusion having

a first surface that is substantially congruent with and conforms to said non-active surface and may be thermally coupled to said non-active surface and

a sidewall that extends between the boundary of said first surface and said body; and

a heat-conducting path extending from said first surface through said protrusion to a region of said body that is thermally coupled to said fluid when said fluid is circulated through said body.

2. The heat exchanger as defined in claim 1, wherein a passage is provided within said body through which said fluid may be circulated, said passage comprising a series of generally spherical chambers separated by generally cylindrical constrictions, and the transitions between the chambers and the constrictions are smooth.

3. The heat exchanger as defined in claim 2, wherein said sidewall is generally perpendicular to the said first surface at its line of contact therewith and has a radius of curvature of at least six mm and the surface of said body is at least six mm from the plane of said first surface.

4. The heat exchanger as defined in claim 1, wherein:

said body is cuboid, having broad parallel upper and lower faces and four sides;

said protrusion extends downward from said lower face; and

said sidewall has a radius of curvature that is approximately equal to the perpendicular distance between the plane of said first surface and said lower face.

5. The heat exchanger as defined in claim 4, wherein a passage is provided within said body through which said fluid may be circulated, said passage comprising a series of chambers separated by constrictions.

6. The heat exchanger as defined in claim 5, wherein the chambers are generally spherical, the constrictions are generally cylindrical, and the transitions between the chambers and the constrictions are smooth.

7. The heat exchanger as defined in claim 6, wherein the perpendicular distance between the plane of said first surface and said lower face is at least six mm.

8. The heat exchanger as defined in claim 7, wherein the heat exchanger is cast in one piece from an aluminum alloy.

9. A heat exchanger for extracting heat from an electronic device through a hot portion of the surface of said electronic device, comprising:

a body through which a fluid may be circulated;

a protrusion extending from said body, said protrusion having a first surface that may be thermally coupled to said hot portion and a sidewall that extends between the boundary of said first surface and said body; and

a heat-conducting path extending from said first surface through said protrusion to a region of said body that is thermally coupled to said fluid when said fluid is circulated through said body,

wherein when said first surface is thermally coupled to said hot portion, the surface of said body is sufficiently distant from said surface of said electronic device that ambient air may circulate therebetween..

10. The heat exchanger as defined in claim 9, wherein said electronic device is a microprocessor comprising a die mounted in a package and the said hot portion is thermally coupled to said die.

11. The heat exchanger as defined in claim 10, wherein:

said electronic device is a microprocessor comprising a die mounted in a package;

said package has a generally planar upper surface above which a planar non-active surface of said die extends; and

said non-active surface is said hot portion.

12. The heat exchanger as defined in claim 11, wherein said first surface is substantially congruent with and conforms to said non-active surface.

13. The heat exchanger as defined in claim 12, wherein a passage is provided within said body through which said fluid may be circulated, said passage comprising a series of chambers separated by constrictions.

14. The heat exchanger as defined in claim 13, wherein said passage follows a path through said body that is topologically equivalent to a spiral, entering said body at a location adjacent to said protrusion and winding in a direction generally away from said protrusion.

15. The heat exchanger as defined in claim 14, wherein said heat exchanger is comprised of:

a central section having a first face and a second face that are substantially parallel to each other;

a first side section and a second side section, each said side section having two substantially parallel faces, one face of the first side section mating with said first face of said central section and one face of said second side section mating with said second face of said central section; and

two end caps for mating with said faces of said side sections not mating with said central section,

wherein:

said protrusion extends from said central section,

each said section contains interior spaces each of which opens to both faces of said section, said side sections having selected ones of said interior spaces connected together within said side sections so that said passage is formed when said sections and said end caps are mated together, and

said heat exchanger is assembled by joining said mating faces together.

16. The heat exchanger as defined in claim 15, wherein said internal spaces are defined by substantially cylindrical walls that are substantially perpendicular to the faces of said sections.

17. The heat exchanger as defined in claim 13, further comprising a heat pipe extending from within said protrusion into said body, whereby said heat pipe provides a portion of said heat-conducting path.

18. The heat exchanger as defined in claim 17, wherein said protrusion includes a heat-conducting plate, one of the surfaces of said plate thermally coupled to said heat pipe and the other surface of said plate providing said first surface.

19. The heat exchanger as defined in claim 18, said heat pipe comprising a cavity defined by said heat-conducting plate, a cylindrical bore beginning at said heat-conducting plate, passing through said protrusion and said body, and ending in an opening at the end of said

bore opposite to said heat-conducting plate, said opening for receiving a plug to seal said cavity.

20. The heat exchanger as defined in claim 19, wherein said passage follows a path through said body that is topologically equivalent to a spiral, entering said body at a location adjacent to said protrusion and winding around said heat pipe and away from said protrusion.

21. The heat exchanger as defined in 20, wherein said heat exchanger is comprised of:

a central section having a first face and a second face that are substantially parallel to each other;

a first side section and a second side section, each said side section having two substantially parallel faces, one face of the first side section mating with said first face of said central section and one face of said second side section mating with said second face of said central section; and

two end caps for mating with said faces of said side sections not mating with said central section,

wherein:

said protrusion extends from said central section,

each said section contains interior spaces each of which opens to both faces of said section, said side sections having selected ones of said interior spaces connected together within said side sections so that said passage is formed when said sections and said end caps are mated together, and

said heat exchanger is assembled by joining said mating faces together.

22. The heat exchanger as defined in claim 21, wherein said internal spaces are defined by substantially cylindrical walls that are substantially perpendicular to the faces of said sections.

23. The heat exchanger as defined in claim 22, wherein said heat pipe is in said central section.

24. A heat exchanger for extracting heat from an electronic device through a hot portion of the surface of said electronic device, comprising a body through which a fluid may be circulated, said body having:

a first surface that may be thermally coupled to said hot portion; and

a heat-conducting path from said first surface to a region of said body that is thermally coupled to said fluid when said fluid is circulated through said body,

such that, when said first surface is thermally coupled to said hot portion, the surface of said body other than said first surface is sufficiently distant from the surface of said electronic device other than said hot portion that ambient air may circulate therebetween.

25. The heat exchanger as defined in claim 24, wherein said electronic device is a microprocessor comprising a die mounted in a package, said package having a generally planar upper surface above which a planar non-active surface of said die extends, and said non-active surface is said hot portion.

26. The heat exchanger as defined in claim 25, wherein said first surface is substantially congruent with and conforms to said hot portion so that said first surface may be thermally coupled to said hot portion.

27. A heat exchanger for extracting heat from an electronic device through a hot portion of the surface of said electronic device, comprising:

a body that may be cooled by a circulating fluid, said body having a first surface that may be thermally coupled to said hot portion;

a conduit for circulating said fluid; and

a heat-conducting path from said first surface to a portion of said body that is thermally coupled to said fluid when said fluid is circulated,

such that when said first surface is thermally coupled to said hot portion the surface of said body other than said first surface and the conduit are sufficiently distant from the surface of said electronic device other than said hot portion that ambient air may circulate therebetween.

28. The heat exchanger as defined in claim 27, wherein said conduit for circulating said fluid is substantially outside said body.

29. The heat exchanger as defined in claim 28, wherein said conduit for circulating said fluid comprises a length of tubing wound around said body.

30. The heat exchanger as defined in claim 29, wherein said body has a protrusion and said first surface is located on said protrusion.

31. The heat exchanger as defined in claim 30, wherein said electronic device is a microprocessor comprising a die mounted in a package, said package having a generally planar upper surface above which a parallel planar non-active surface of said die extends, and the said hot portion is said non-active surface of said die.

32. The heat exchanger as defined in claim 31, wherein said first surface is substantially congruent with and conforms to said hot portion so that said first surface may be thermally coupled to said hot portion.

33. An apparatus for cooling an electronic device, comprising:

a first fluid heat exchanger for transferring heat from a hot portion of the surface of said electronic device to a fluid, said first fluid heat exchanger comprising

a body through which said fluid may be circulated,

a protrusion extending from said body, said protrusion having a first surface that may be thermally coupled to said hot portion and a sidewall that extends between the boundary of said first surface and said body, and

a heat-conducting path extending from said first surface through said protrusion to a region of said body that is thermally coupled to said fluid when said fluid is circulated through said body;

a chiller for chilling said fluid; and

a pump for circulating said fluid through said chiller and said first fluid heat exchanger.

34. The apparatus as defined in claim 33, wherein said electronic device is a microprocessor comprising a die mounted in a package, said package having a generally planar upper surface above which a planar non-active surface of said die extends, and the said hot portion is said non-active surface.

35. The apparatus as defined in claim 34, wherein said first surface is substantially congruent with and conforms to said hot portion so that said first surface may be thermally coupled to said hot portion.

36. The apparatus as defined in claim 35, wherein when said first surface is thermally coupled to said hot portion, the surface of said body is sufficiently distant from said upper surface that ambient air may circulate therebetween.

37. The apparatus as defined in claim 35, wherein said sidewall is generally perpendicular to the said first surface and all of the surface of said body is at least six mm from the plane of said first surface.

38. The apparatus as defined in claim 35, wherein a passage is provided within said body through which said fluid may be circulated, said passage comprising a series of chambers separated by constrictions.

39. The apparatus as defined in claim 38, wherein said passage follows a path through said body that is topologically equivalent to a spiral, entering said body at a location adjacent to said protrusion and winding in a direction generally away from said protrusion.

40. The apparatus as defined in claim 39, wherein said first heat exchanger is comprised of:

a central section having a first face and a second face that are substantially parallel to each other;

a first side section and a second side section, each said side section having two substantially parallel faces, one face of the first side section mating with said first face of said central section and one face of said second side section mating with said second face of said central section; and

two end caps for mating with said faces of said side sections not mating with said central section,

wherein:

said protrusion extends from said central section,

each said section contains interior spaces each of which opens to both faces of said section, said side sections having selected ones of said interior spaces connected together within said side sections so that said passage is formed when said sections and said end caps are mated together, and

said first heat exchanger is assembled by joining said mating faces together.

41. The apparatus as defined in claim 38, further comprising a heat pipe extending from within said protrusion into said body, whereby said heat pipe provides a portion of said heat-conducting path.

42. The apparatus as defined in claim 41, wherein said protrusion includes a heat-conducting plate, one of the surfaces of said plate thermally coupled to said heat pipe and the other surface of said plate providing said first surface.

43. The apparatus as defined in claim 42, said heat pipe comprising a cavity defined by said heat-conducting plate, a cylindrical bore beginning at said heat-conducting plate, passing through said protrusion and said body, and ending in an opening at the end of said bore opposite to said heat-conducting plate, said opening for receiving a plug to seal said cavity.

44. The apparatus as defined in claim 43, wherein said passage follows a path through said body that is topologically equivalent to a spiral, entering said body at a location adjacent to said protrusion and winding around said heat pipe and away from said protrusion.

45. The apparatus as defined in claim 44, wherein said first heat exchanger is comprised of:

a central section having a first face and a second face that are substantially parallel to each other;

a first side section and a second side section, each said side section having two substantially parallel faces, one face of the first side section mating with said first face of said central section and one face of said second side section mating with said second face of said central section; and

two end caps for mating with said faces of said side sections not mating with said central section,

wherein:

said protrusion extends from said central section,

each said section contains interior spaces each of which opens to both faces of said section, said side sections having selected ones of said interior spaces connected

together within said side sections so that said passage is formed when said sections and said end caps are mated together, and

said first heat exchanger is assembled by joining said mating faces together.

46. The heat exchanger as defined in claim 45, wherein said internal spaces are defined by substantially cylindrical walls that are substantially perpendicular to the faces of said sections.

47. The heat exchanger as defined in claim 46, wherein said heat pipe is in said central section.

48. The heat exchanger as defined in claim 47, wherein said heat pipe contains a mixture consisting essentially of acetone, isopropyl alcohol, and water as a working fluid.

49. The apparatus as defined in claim 33, wherein said chiller comprises:

a second fluid heat exchanger through which said fluid may be circulated;

a heat spreader plate one face of which is thermally coupled to said second heat exchanger; and

a stack of spaced-apart heat conductive fins, each of which is thermally coupled to said heat spreader plate and extending from the face of said heat spreader plate opposite to said face of said heat spreader plate that is thermally coupled to said second fluid heat exchanger.

50. The apparatus as defined in claim 49, further comprising a fan oriented to blow air between said fins.

51. The apparatus as defined in claim 50, further comprising a thermoelectric cooler having a cool face and a warm face when connected to a power source, said thermoelectric cooler interposed between said second fluid heat exchanger and said heat spreader plate so that said cool face is thermally coupled to said second fluid heat exchanger and said warm face is thermally coupled to said heat spreader plate.

52. The apparatus as defined in claim 33, wherein said chiller comprises:

a second fluid heat exchanger through which said fluid may be circulated, said second fluid heat exchanger having two substantially parallel extended faces;

two heat spreader plates, each having a first extended face thermally coupled to a discrete extended face of said second fluid heat exchanger and each having a second extended face substantially parallel to its first extended face; and

two stacks of spaced-apart heat conductive fins, each stack thermally coupled to said second extended face of a discrete one of said heat spreader plates so that said fins are substantially perpendicular to a plane that is parallel to said heat spreader plates.

53. The apparatus as defined in claim 52, wherein all of said fins are substantially parallel to a each other.

54. The apparatus as defined in claim 53, further comprising a fan oriented to blow air between all of said fins in a direction substantially parallel to said heat spreader plates.

55. The apparatus as defined in claim 54, further comprising a cylindrical housing, wherein said fan, said second fluid heat exchanger, said heat spreader plates, and said fin stacks are mounted inside said housing.

56. The apparatus as defined in claim 55, wherein the lengths of said fins are selected so that each extends to the interior wall of said housing.

57. The apparatus as defined in claim 56, wherein each fin stack includes a base plate and is extruded as a unitary structure.

58. The apparatus as defined in claim 56, wherein each heat spreader plate and associated fin stack is extruded as a unitary structure.

59. The apparatus as defined in claim 52, further comprising two thermoelectric coolers, each having a cool face and a warm face when connected to a power source, each thermoelectric cooler interposed between said second fluid heat exchanger and a discrete one of said heat spreader plates so that said cool face of each said thermoelectric cooler is thermally coupled to said second fluid heat exchanger and said warm face is thermally coupled to one of said heat spreader plates.

60. The apparatus as defined in claim 33, further comprising a tank and wherein said pump is a submersible-type pump and is housed in said tank so that when in operation said pump is submerged in said fluid.

61. The apparatus as defined in claim 60, wherein said pump requires AC power and further comprising a DC to AC inverter for providing AC power to said pump.